

Pink Hibiscus Mealybug Biological Control in Imperial Valley, California, 2003 Update

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The pink hibiscus mealybug (PHM), *Maconellicoccus hirsutus* (Green), was first detected in Imperial Valley, California in August 1999. Population densities of PHM on mulberry, carob, silk oak, hibiscus, and natal plum were determined to be high in several urban communities in southern Imperial Valley. Two parasitoid species, *Anagyrus kamali* Moursi and *Gyranusoidea indica* Shafee, Alam and Agarwal, were released at 10 sites in the fall of 1999. Subsequently, an insectary was established in El Centro for additional parasitoid production. The two species were then produced locally and released beginning in 2000. The culture of *A. kamali* that was propagated through 2001 originated from collections in China and Hawaii that were combined. *Gyranusoidea indica* was a combination of populations from Egypt, Pakistan, and Australia. In 2002, a population of *Anagyrus kamali* (collector: D. Gonzalez, University of California, (UC) Riverside) from southern Egypt was reared and released.

We received permits for rearing an additional parasitoid, *Allotropa* sp. nr. *mecrida* (Hymenoptera: Platygasteridae), in November 2002. This population was collected in the very warm and dry climate of southern Egypt by Dr. Dan Gonzalez, UC Riverside in 2000. In 2003, we produced and released nearly 300,000 parasitoids (Table 1). They were either released in Imperial Valley or provided to Mexican authorities for release in the adjacent Mexicali Valley. Parasitoids were initially released at sites on the perimeter of the infested area. As the season progressed, releases were made at progressively interior locations. This approach avoided releases being made within several city blocks of long-term monitoring sites until the fall of 2003.

Table 1. Destinations of pink hibiscus mealybug parasitoid *Allotropa* sp. nr. *Mecrida* produced at the California Department of Food and Agriculture Insectary, El Centro, CA, in 2003.

Month	Imperial Valley	No. of Sites in Imperial Valley	Mexico	Monthly Parasitoid Release Totals
January	5,000	4		5,000
February	8,800	13		8,800
March	22,000	28		22,000
April	23,000	26		23,000
May	3,500	5		3,500
June	5,000	6	4,000	9,000
July	2,500	5	4,800	7,300
August	34,000	38	21,000	55,000
September	33,000	33	24,000	57,000
October	24,000	20	26,000	50,000
November	13,000	13	9,000	22,000
December	35,000	35		35,000
Total to Date	208,800	226	88,800	297,600

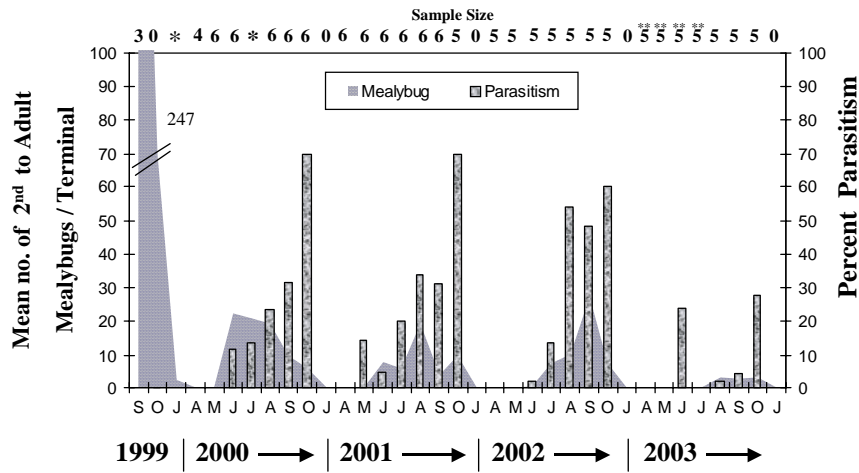


Figure 1. Pink hibiscus mealybug and parasitism on mulberry trees in Imperial Valley, California. Mulberry terminal samples in January are available with buds only. Sample size equals the number of sites sampled by date. [* = % parasitism only was calculated, ** = % parasitism was calculated for 1 or 0 sites].

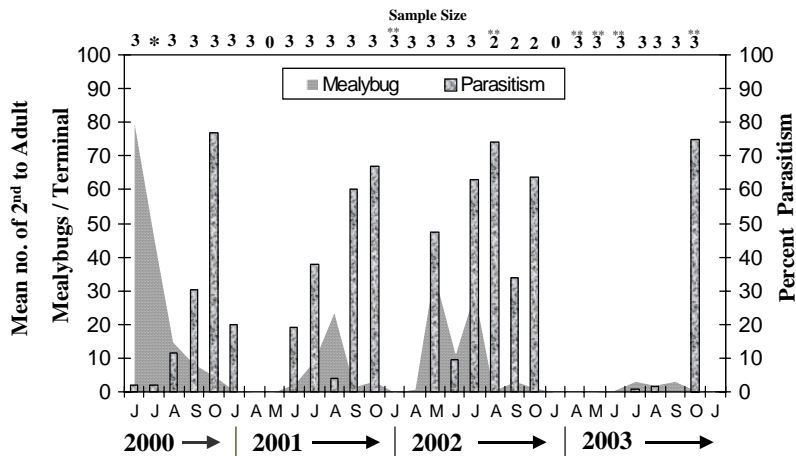


Figure 2. Pink hibiscus mealybug and parasitism on carob trees in Imperial Valley, California. Sample size equals the number of sites sampled by date. [* = percent parasitism only was calculated, ** = percent parasitism was calculated for 1 or 0 sites].

Monitoring of PHM population density and parasitism on mulberry and carob trees occurred primarily at the same sites (i.e., long-term sites) selected at the inception of the PHM project. Population densities on infested mulberry trees averaged over 200 mealybugs/terminal in September 1999 (Figure 1). Corresponding with the broad establishment of *Anagyrus kamali*, PHM densities have been consistently low for four consecutive years. *Gyranusoidea indica* is also established in Imperial Valley; however, its numbers are typically low during the year, particularly during the warmest months

from June through September. In 2002, less than 10% of all parasitoids collected during the year were *G. indica*; however, *G. indica* represented 21% of the primary parasitoids collected in October. Similar results have been recorded at three study sites consisting of carob trees (Figure 2). PHM densities were initially high on carob trees, but with the onset of parasitism, they have become considerably lower. In 2003, PHM densities were the lowest of all years to date (Figures 1 and 2) and *Anagyrus kamali* continues to be the dominant parasitoid. Due to very low PHM densities in 2003, it was not feasible to collect PHM specimens for assessing the percent parasitism at many sites. Overall, the percent parasitism in 2003 was considerably lower than in past years, presumably reflecting a density dependent relationship with PHM.

The impact of native (to Imperial Valley, CA) hyperparasitoid species on newly introduced primary parasitoid species is being monitored. A hyperparasitic species (*Marietta* sp.) was first collected in July 2000. At that time, its occurrence was quite rare. Dissected samples confirmed that the primary parasitoid, *A. kamali*, was under attack by *Marietta* sp. (Aphelinidae) and to a lesser extent by *Chartocerus* sp. (Signiphoridae). *Marietta* sp. was common through the remainder of 2000, as represented by the percent of PHM mummies from which hyperparasitoids emerged [(mean percentage, number of sample sites): late July 11%, five sites; late August 60%, six sites; September 16%, six sites; and October 51%, nine sites]. Hyperparasitoid attack of *A. kamali* declined after 2000 (Fig 3). In 2003, *Marietta* sp. was common during one sample date at two locations. Elsewhere, it was rarely found. From four samples taken during September 2003, hyperparasitism was estimated to be 32%. *Chartocerus* sp. was not collected in 2003.

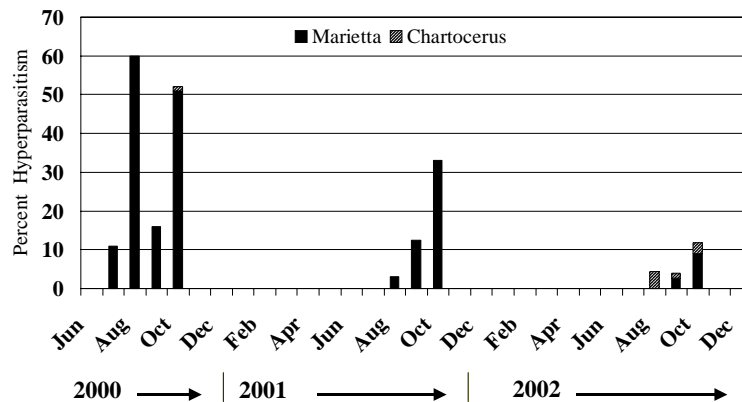


Figure 3. Hyperparasitism of pink hibiscus mealybug parasitoids in Imperial Valley, California.

A number of samples of two resident species of mealybug have been collected over several years to monitor for non-target impacts. Ten separate collections of the solenopsis mealybug, *Phenacoccus solenopsis* Tinsley and 13 collections of the striped

mealybug, *Ferrisia virgata* (Cockerell) have been made in Imperial Valley. The former species is native, whereas the latter is not a native species. To date, neither *A. kamali* nor *G. indica* have been recovered from either mealybug species, thereby demonstrating that they are either moderately or highly host specific. In summary, two biological control agents released against PHM have become widely established throughout infested areas of Imperial Valley, and one species has had considerable impact to date. The third newly released species has also shown strong signs of establishment to date. The average regional density of PHM has markedly decreased (>95% reduction) since 1999. Moreover, the distribution of PHM has remained unchanged continuing to be restricted to urban locations within the southern half of Imperial Valley.

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